

NAME: \_\_\_\_\_

**MATH UNIT**  
*Chapter Outline*

Vocabulary

second

meter

kilogram

liter

Kelvin

scientific notation

conversion factor

dimensional analysis

Objectives

- ✓ **Define** SI units for time, length, mass, and temperature.
- ✓ **Explain** how adding a prefix changes a unit.
- ✓ **Express** numbers in scientific notation.
- ✓ Use dimensional analysis to **convert** between units.

# MATH UNIT

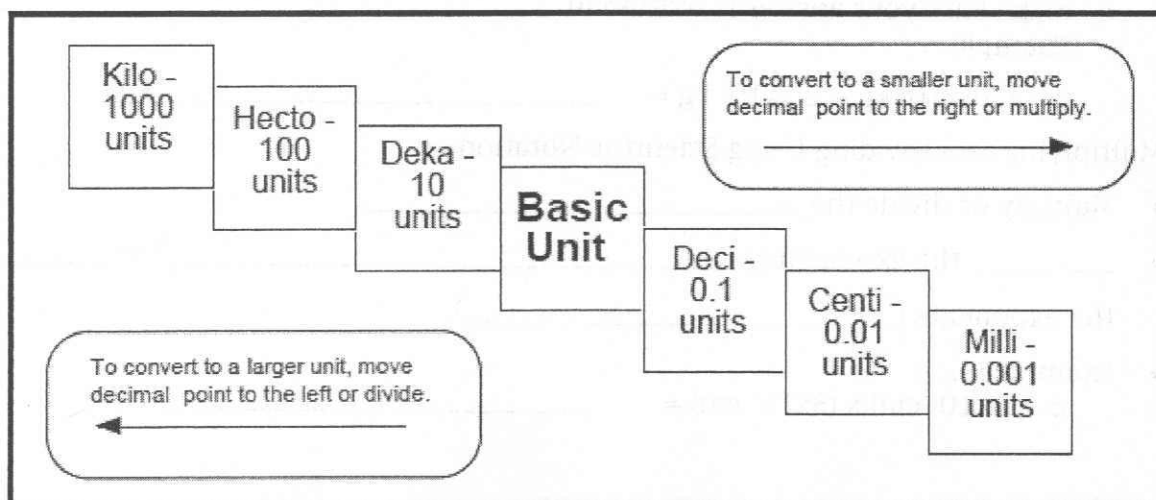
## Notes Outline

### Units of Measurement

SI Base Units	
Quantity	Base unit
Time	second (s)
Length	meter (m)
Mass	kilogram (kg)
Temperature	kelvin (K)
Amount of a substance	mole (mol)
Electric current	ampere (A)
Luminous intensity	candela (cd)

Prefixes Used with SI Units				
Prefix	Symbol	Factor	Scientific notation	Example
giga	G	1 000 000 000	$10^9$	gigameter (Gm)
mega	M	1 000 000	$10^6$	megagram (Mg)
kilo	k	1000	$10^3$	kilometer (km)
deci	d	1/10	$10^{-1}$	deciliter (dL)
centi	c	1/100	$10^{-2}$	centimeter (cm)
milli	m	1/1000	$10^{-3}$	milligram (mg)
micro	$\mu$	1/1 000 000	$10^{-6}$	microgram ( $\mu$ g)
nano	n	1/1 000 000 000	$10^{-9}$	nanometer (nm)
pico	p	1/1 000 000 000 000	$10^{-12}$	picometer (pm)

hecto- (h) →  
deka- (da) →



- Examples...

- 1000 mg = \_\_\_\_\_ g
- 160 cm = \_\_\_\_\_ mm
- 109 g = \_\_\_\_\_ kg
- 1 L = \_\_\_\_\_ mL
- 14 km = \_\_\_\_\_ m

### Scientific Notation

- \_\_\_\_\_ expresses numbers as a multiple of two factors: a \_\_\_\_\_; and \_\_\_\_\_, or exponent.

- The exponent tells you how many times the first factor must be multiplied by 10.
- When numbers \_\_\_\_\_ are expressed in scientific notation, the power of 10 is \_\_\_\_\_.
- When numbers \_\_\_\_\_ are expressed in scientific notation, the power of 10 is \_\_\_\_\_.
- Examples...
  - Change the following data into scientific notation:
    - The diameter of the Sun is 1,392,000 km.
    - The density of the Sun's lower atmosphere is 0.000000028 g/cm<sup>3</sup>.

- Adding and Subtracting Using Scientific Notation

- The exponents must be \_\_\_\_\_ before doing the arithmetic.
- Add or subtract the \_\_\_\_\_.
- Keep the exponent \_\_\_\_\_.
- Make sure your answer is written in \_\_\_\_\_.
- Example...
  - $1.26 \times 10^4 \text{ kg} + 2.5 \times 10^3 \text{ kg} =$  \_\_\_\_\_ kg

- Multiplying and Dividing Using Scientific Notation

- Multiply or divide the \_\_\_\_\_.
- \_\_\_\_\_ the exponents (\_\_\_\_\_) or \_\_\_\_\_ the exponents (\_\_\_\_\_).
- Examples...
  - $(2 \times 10^3 \text{ cm}) \times (3 \times 10^2 \text{ cm}) =$  \_\_\_\_\_ cm<sup>2</sup>

○  $(9 \times 10^8 \text{ g}) \div (3 \times 10^{-4} \text{ mL}) =$  \_\_\_\_\_ g/mL

### Dimensional Analysis

- A \_\_\_\_\_ is a ratio of equivalent values used to express the same quantity in different units.
  - A conversion factor is \_\_\_\_\_.
- \_\_\_\_\_ is a method of problem-solving that focuses on the units used to describe matter.
  - Dimensional analysis often uses conversion factors.
  - When you convert from a \_\_\_\_\_, the number of units must \_\_\_\_\_.
  - When you convert from a \_\_\_\_\_, the number of units must \_\_\_\_\_.
  - Examples...
    - How many seconds are there in 24 hours?
    - A car is traveling 90.0 kilometers per hour. What is its speed in miles per minute?

**1 km = 0.62 miles**

**1 hr = 60 mins**

**1 min = 60 secs**

**Conversion Challenge**

Write the correct abbreviation for each metric unit.

- |                   |                     |                     |
|-------------------|---------------------|---------------------|
| 1) Kilogram _____ | 4) Milliliter _____ | 7) Kilometer _____  |
| 2) Meter _____    | 5) Millimeter _____ | 8) Centimeter _____ |
| 3) Gram _____     | 6) Liter _____      | 9) Milligram _____  |

Try these conversions, using the ladder method.

- |                      |                      |                       |
|----------------------|----------------------|-----------------------|
| 1) 2000 mg = _____ g | 6) 5 L = _____ mL    | 11) 16 cm = _____ mm  |
| 2) 104 km = _____ m  | 7) 198 g = _____ kg  | 12) 2500 m = _____ km |
| 3) 480 cm = _____ m  | 8) 75 mL = _____ L   | 13) 65 g = _____ mg   |
| 4) 5.6 kg = _____ g  | 9) 50 cm = _____ m   | 14) 6.3 cm = _____ mm |
| 5) 8 mm = _____ cm   | 10) 5.6 m = _____ cm | 15) 120 mg = _____ g  |

Compare using <, >, or =.

- |                                         |                                     |                                         |
|-----------------------------------------|-------------------------------------|-----------------------------------------|
| 16) 63 cm <input type="text"/> 6 m      | 17) 5 g <input type="text"/> 508 mg | 18) 1,500 mL <input type="text"/> 1.5 L |
| 19) 536 cm <input type="text"/> 53.6 dm | 20) 43 mg <input type="text"/> 5 g  | 21) 3.6 m <input type="text"/> 36 cm    |

# Scientific Notation

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Convert each number from scientific notation to real.**

(1)  $4.427 \times 10^{-1}$

(6)  $1.883 \times 10^{-6}$

(2)  $9.952 \times 10^6$

(7)  $3.412 \times 10^2$

(3)  $3.858 \times 10^{-3}$

(8)  $9.748 \times 10^3$

(4)  $3.673 \times 10^4$

(9)  $4.297 \times 10^{-4}$

(5)  $5.862 \times 10^{-5}$

(10)  $7.437 \times 10^2$

**Convert each number from real to scientific notation.**

(11) 0.002397

(16) 5,167

(12) 93.29

(17) 0.0005511

(13) 6,139

(18) 0.009578

(14) 1.772

(19) 0.00006144

(15) 73.12

(20) 0.03592

Student Name: \_\_\_\_\_

Score: \_\_\_\_\_

**Adding and Subtracting Numbers in Scientific Notation***Example:*  $3 \times 10^4 + 2.5 \times 10^5$ 

$$\begin{aligned} &3 \times 10^4 + 2.5 \times 10^5 \\ &= 0.3 \times 10^5 + 2.5 \times 10^5 \\ &= (0.3 + 2.5) \times 10^5 \\ &= 2.8 \times 10^5 \end{aligned}$$

Answer:  $2.8 \times 10^5$  $2.5 \times 10^4 - 1.5 \times 10^3$ 

Answer:

 $1.43 \times 10^2 + 7.105 \times 10^5$ 

Answer:

 $7.1567 \times 10^3 + 5.5 \times 10^6$ 

Answer:

 $1.2 \times 10^2 - 6 \times 10^3$ 

Answer:

 $9.65 \times 10^7 - 8.1 \times 10^6$ 

Answer:

Student Name: \_\_\_\_\_

Score: \_\_\_\_\_

**Multiplying Numbers in Scientific Notation***Example:*  $(4.1 \times 10^2)(9.5 \times 10^3)$ 

$$\begin{aligned} &(4.1 \times 10^2)(9.5 \times 10^3) \\ &= (4.1 \times 9.5) \times (10^2 \times 10^3) \\ &= 38.95 \times 10^{2+3} \\ &= 38.95 \times 10^5 \\ &= 3.895 \times 10^6 \end{aligned}$$

Answer:  **$3.895 \times 10^6$**  $(6 \times 10^4)(8 \times 10^5)$ 

Answer: \_\_\_\_\_

 $(1.4 \times 10^3)(5.2 \times 10^4)$ 

Answer: \_\_\_\_\_

 $(8.102 \times 10^6)(1.3 \times 10^1)$ 

Answer: \_\_\_\_\_

 $(7.538 \times 10^0)(1.952 \times 10^7)$ 

Answer: \_\_\_\_\_

 $(5.21 \times 10^4)(9.5 \times 10^6)$ 

Answer: \_\_\_\_\_



Student Name: \_\_\_\_\_

Score: \_\_\_\_\_

**Dividing Numbers in Scientific Notation***Example:*  $(6.27 \times 10^5) \div (1.9 \times 10^3)$ 

$$\begin{aligned} & (6.27 \times 10^5) \div (1.9 \times 10^3) \\ &= (6.27 \div 1.9) \times (10^5 \div 10^3) \\ &= 3.3 \times 10^{5-3} \\ &= 3.3 \times 10^2 \end{aligned}$$

Answer:  $3.3 \times 10^2$  $(5 \times 10^4) \div (2.5 \times 10^2)$ 

Answer:

 $(2.4 \times 10^7) \div (3.5 \times 10^9)$ 

Answer:

 $(7.43 \times 10^4) \div (2.1 \times 10^4)$ 

Answer:

 $(7.1 \times 10^4) \div (8.2 \times 10^{11})$ 

Answer:

 $(8.306 \times 10^{11}) \div (9.54 \times 10^8)$ 

Answer:

# U. S. – Metric Conversions

## Length

1 in = 2.54 cm  
 1 ft = 30.5 cm  
 1 yd = 91.4 cm  
 1 mi = 1610 m  
 1 mi = 1.61 km  
 0.0394 in = 1 mm  
 0.394 in = 1 cm  
 39.4 in = 1 m  
 3.28 ft = 1 m  
 1.09 yd = 1 m  
 0.621 mi = 1 km

## Weight

1 oz = 28.3 g  
 1 lb = 454 g  
 1 lb = 0.454 kg  
 0.0353 oz = 1 g  
 0.00220 lb = 1 g  
 2.20 lb = 1 kg

## Capacity

1 gal = 3.79 L  
 1 qt = 0.946 L  
 0.264 gal = 1 L  
 1.06 qt = 1 L

1. 2500 m = \_\_\_\_\_ km

2. 3.54 m = \_\_\_\_\_ cm

3. 1,234,560 cm = \_\_\_\_\_ km

4. 30,000 kg = \_\_\_\_\_ g

5. 48 oz = \_\_\_\_\_ lb

6. 2.4 mi = \_\_\_\_\_ ft

7. 420 hr = \_\_\_\_\_ wks

8.  $\frac{3}{4}$  hr = \_\_\_\_\_ sec

9.  $88 \frac{\text{ft}}{\text{sec}} = \frac{\text{mi}}{\text{hr}}$

10.  $45 \frac{\text{mi}}{\text{hr}} = \frac{\text{ft}}{\text{sec}}$

11. 220 grams = \_\_\_\_\_ lb

12. 12 grams = \_\_\_\_\_ grains

13. 17.0 in = \_\_\_\_\_ cm

14. 1950 g = \_\_\_\_\_ lb

15.  $0.85 \text{ qt} = \underline{\hspace{2cm}} \text{ mL}$

16.  $61 \text{ cm} = \underline{\hspace{2cm}} \text{ ft}$

17.  $1.2 \text{ kg} = \underline{\hspace{2cm}} \text{ oz}$

18.  $2 \text{ L} = \underline{\hspace{2cm}} \text{ pt}$

19. The distance from a Port Huron to the Indiana State line is approximately 271 miles (via I-94). Express this distance in kilometers.

20. A baby born in the US weighs 3.295 kg according to the scale in the birthing room. Convert this to pounds and ounces so you can tell the grandparents how much the baby weighed.

21. A child requires a 5 ml dose of medicine each day. How many days would a gallon of this medicine last?

22. The moon is 384,403 km from the earth. Estimate how many quarters laid end to end it would take to reach the moon if a quarter has a diameter of 2.3 cm.

23. How many years old are you if you have lived 1 billion seconds?

24. 1 milliliter of ink can print 50 pages of text. If you had 100 gallons of ink then how many pages could you print?

25. A clerk can sort 375 sheets per hour. If there are 225 sheets in an inch, how long will it take her to file 125 inches of loose sheets.